NOTE XI.

DESCRIPTIONS OF EARTHWORMS

BY

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VIII.

ON A LARGE EARTHWORM FROM BORNEO.

Moniligaster coeruleus n. sp.

(Plate 7).

My colleague Mr. J. Büttikofer, at this moment making part of an expedition in West-Borneo, collected on the Goenong Kenepai a large earthworm, belonging to the family of the *Moniligastridae*.

Though our knowledge of the organisation of this interesting group much increased in the last years thanks to the careful investigations of Rosa, Beddard and Benham, there yet remain some points in their structure upon which further information is desirable; I will therefore not defer any longer to give a description of this new species, for which I propose the name of *Moniligaster coeruleus*.

The length of the single specimen is 380 mm.; on segment XIII it measures 15 mm. in diameter. The body consists of about 270 segments. When we except *M. Houtenii* [1]), which probably will prove to belong to an other genus, our worm is the largest *Moniligaster*-species hitherto

1) Zoolog. Ergebn. einer Reise in Niederl. Ost-Indien, Bd. II, 1892, p. 46. Notes Leyden Museum, Vol. IX, 1887, p. 97, Pl. I, figs. 1—3.

known, *M. Deshayesi* from Ceylon [1]) and *M. indicus* [2]) from the Nilgiris being scarcely half as long, and most species do not measure more than 30 mm.

The colour of the worm at the dorsal side is bluish-brown, at its ventral side yellowish-brown. The brown colour is produced by a pigment, situated in the epidermis, and the blue one is not as usually due to the iridescence of the cuticula, but appears to belong to the circular muscle-layer, which possesses an ultramarine hue, especially in its outermost layers. No pigment could be detected in this layer, and the colour appears rather to be produced by the particular structure of the circular muscles. As also stated by Beddard in *M. bahamensis* [3]) the transverse muscular coat shows a honey-combed structure in longitudinal sections [4]), for in each muscle-fibre the external layer of fibrillated substance is very narrow as compared to the central body of granular matter; in this central body, which is clear and highly refractive the blue colour resides.

Like as in most other *Moniligaster*-species no clitellum is visible. The prostomium is rounded, not extending backward; ist exact shape however could not be recognized, because the wall of the buccal cavity is everted. The buccal segment is very short, scarcely half as long as the second segment; it is provided with parallel, longitudinal folds.

The setae are arranged in couples; the distance between the two ventral couples is twice as great as the space between the ventral and dorsal ones. Upon the two anterior segments the setae could not be recognized. The

1) Nouv. Arch. du Museum, Vol. VIII, 1872, p. 130, Pl. IV, figs. 77—84.
2) Quart. Journ. Microsc. Science, Vol. XXXIV, 1893, p. 361, Pls. XXXII and XXXIII.
3) Proceed. Zool. Soc. 1892, p. 690.
4) No doubt by a slip of the pen the figure 5 of Plate XLV is called in the explanation a transverse section through the clitellum; it really represents a longitudinal one.

setae (fig. 1) have the usual shape, though they are but slightly curved; they measure 1 mm. in length. The free extremity of each seta is furnished with crenulated, arched markings like in several Geoscolecidae. *Moniligaster Houtenii* has also its setae ornamented, though on a somewhat different manner; moreover they are straighter and smaller.

As to the genital pores only those of the spermathecae and those of the male genital ducts have the position normal for the genus (fig. 5). The spermathecal pores, situated in the intersegmental groove VII/VIII, in the series of the dorsal bristles, are very obvious, button-hole-shaped; the male pores however are very narrow slits in the intersegmental groove X/XI, corresponding to the interval between the ventral and dorsal setae. The oviducal pores are two small but distinct slits upon segment XIII, in front of the ventral bristles. In this point our specimen does not agree with the other *Moniligaster*-species, which have the oviducal pores situated in the intersegmental groove XI/XII, and therefore separated from the male pores only by a single segment; nevertheless there cannot be a mistake, for in the dissected worm I could distinctly recognize the oviduct on its course to the external opening. The nephridial pores were not visible externally, still on examining the internal structure, I could state, that the nephridia open themselves on the exterior in line with the ventral setae, and not with the dorsal ones, as in *Moniligaster indicus*.

As first stated by myself in *Monilig. Houtenii*, so also in the present species the internal segmentation does not correspond to the external one, due to the shifting of several septa. Benham observed the same feature in *Moniligaster indicus*, and according to Rosa it occurs also in *Desmogaster* [1]). The shifting commences with the ninth septum, that instead of being inserted in the intersegmental groove IX/X is attached to the body-wall about in the middle of

1) Ann. Mus. Civ. Stor. Nat. Genova, 2e S. Vol. IX, 1890, p. 368, Pl. XII.

segment X; the next following septum is nearly thrown back a whole segment and is inserted close to the hinder boundary of segment XI. In other *Moniligaster*-species the tenth and eleventh septum meet with each other and are confluent along a part of their surface; in the enclosed space the ovaria and the oviducal-funnel are situated. *Monilig. coeruleus* however shows a different feature, for the eleventh septum is absent, or it is shifted to the middle of segment XIII and there connected with the twelfth septum, the ovaria being enclosed in the intervening space. As no nephidium occurs in the stretch between both septa, I believe it may not be considered to correspond to a somite. The septa of the succeeding segments are all inserted in the body-wall slightly in front of the intersegmental groove.

The septa V/VI, VI/VII, VII/VIII and VIII/IX are thick and muscular like in other *Moniligaster*-species; moreover the six septa behind the gizzard, XIX/XX—XXIV/XXV show the same feature. This is also the case in *M. Houtenii*, but I did not find it mentioned for one of the other species.

The intestinal canal as usually is characterized by the presence of several gizzards; already in segment XIII the wall of the gut presents a muscular appearance, though its anterior bounding is not sharply marked and a transition between the oesophagus and the gizzard seems to occur as in *Monilig. indicus*. The gizzard extends till segment XIX and shows five compartments, separated from each other by an annular fibrous band. Behind the gizzard, in the region of the posterior thickened septa, the intestine becomes narrow and cylindrical; in segment XXV it commences to enlarge, but is very deeply constricted in the five following segments by the corresponding septa. The lateral coeca, thus formed, are highly vascular and are provided with a great number of parallel blood-vessels by a branch of the dorsal trunc, which soon after its origin divides itself fan-like in numerous smaller vessels.

In *Monilig. japonicus* [1]) Michaelsen believes to have found concretions of carbonate of lime in those dilatations of the intestine. The real sacculated intestine commences about segment XXX.

The dorsal vessel is single; commissural vessels are present in segments IV—X. Only those in segments VIII, IX and X are highly dilated.

The *nephridia* of our worm (fig. 2), like in other *Moniligaster*-species, resemble those of *Monilig. Houtenii*; they also possess a long, wide, muscular diverticulum, but the excretory duct is shorter and not so slender. Where the diverticulum passes into the excretory duct, the nephridial tube is constricted and connected with the glandular part of the organ, which shows a large loop, of which the limbs are spirally wound around each other. The nephridia appear to commence in segment III, for in front of the fourth septum I observed two pairs of them; they do not occur however in all the following segments, for they are absent in segment IX and X, in the space between the shifted septa IX/X and X/XI and also in segment XIII and XIV.

A pair of large spermathecae are situated in segment VIII along the sides of the oesophagus; each spermatheca (fig. 3, *sp.*) consists of a pear-shaped sac, which opens on to the exterior by a long and delicate, sinuous duct. In *Monilig. indicus* [2]) the duct appears not to open directly on the exterior, but first to pass into a bilobed sac, with thick muscular coat, which Benham believes to correspond to both the pyramidal organs of *Monilig. Deshayesi*, described by Perrier.

On opening the worm, the *male generative* organs directly strike the attention by their enormous dimensions; they consist of a pair of vesiculae seminales and a pair of prostata-glands, which occupy a large part of the coelomic cavity of segments X, XI and XII. The two seminal vesicles are entirely independent of one another, each of them

1) Archiv f. Naturgesch., 1892, p. 24.

2) loc. cit., figs. 8 and 5.

enclosed in a pouch-like protrusion of the septum IX/X. The funnel is inserted to the innerside of the front-wall of the sac and passes into a delicate, greatly convoluted spermduct, situated along the front-side of the ninth septum and accompanied in its course by a bloodvessel; arrived near the ventral body-wall it traverses the septum, passes backward till into segment XI and opens into the prostata. The *prostata* is an orange-coloured, plain, tubular organ, consisting of two limbs, which form an U-shaped loop and the former of which opens externally into the intersegmental groove X/XI. Its surface is faintly rugose, divided in small polygonal fields, which correspond to the groups of glandular cells, of which the wall of the prostate is composed, and which with their convex base project somewhat above the surface of this organ. In most *Moniligaster*-species the prostata appears to present a more compressed, pyriform shape and to be specialized in two regions, a distal muscular one, the atrium, and a proximal more glandular part, the prostata. Only in *Monilig. Deshayesi* and *M. Houteni* it appears to have a more elongated, tubular appearance. Though my material did not permit an investigation of the finer histology of the prostata, on a transverse section, made with the razor, its structure could distinctly be recognized.

This perfectly agrees with the structure of the prostata of *Monilig. indicus*, as described and figured by Benham, Pl. XXXIII, fig. 9, only the muscular layer lies nearer to the epithelium, that surrounds the lumen, like as in *Monilig. Barwelli* [1]). The fascicles of long, narrow ducts of the club-shaped gland-cells, could not only easily be distinguished, but I observed, that those ducts were closely brought together in the muscular coat, and after having traversed this layer again diverged, probably to make place for the epithelial cells, lying between their necks. I found the epithelial layer lined by a distinct cuticula. In the pro-

1) Quart. Journ. Micr. Science, Vol. XXIX, Pl. XII, figs. 10—12.

stata of *Desmogaster* the muscular coat appears to be more developed as in *Moniligaster*.

The ovary is extremely large; in the space between the two confluent septa in segment XIII, it is attached to the anterior of both, extending like a fringed band from the dorsal to the ventral side. It consists of numerous lobes, showing a somewhat conical shape and each furnished with a couple of blood-vessels united in a loop (fig. 4). The anterior side of the opposite septum bears ventrally the folded oviducal funnel, dorsally the slit-like opening of the receptaculum ovorum; both are situated on a distance from each other, but are connected by a folded ridge, which I suppose is coated with cilia, along which the ova are transported from the receptaculum to the funnel. The short oviduct traverses the septum and opens into the porus situated in line with seta 2. The receptaculum ovorum is rather great, though not so large as in some other *Moniligaster*-species, in which it extends over several segments; it has the shape of a cap and only occupies one segment. According to the description of Rosa and Benham the ovaries of *Monilig. Beddardi* and *M. indicus* have a cylindrical, spirally coiled shape, and that of *M. japonicus* is described by Michaelsen as »ein hoher büschelig oder zottiger Besatz"; none of those authors however speaks of the particular division in lobes and the loops of bloodvessels penetrating in them.

In an interesting paper, dealing with the anatomy of *Monilig. indicus*, Benham recently summarized the characters, by which the genus *Moniligaster* is distinguished. Among the ten characters enumerated by this author there are two, as above referred to, which our species does not possess; viz. the oviducal pores, instead of in the intersegmental groove XI/XII, occur upon segment XIII, and the nephridial pores are not situated in line with the dorsal, but with the ventral setae. Though this different position of the oviducal pores no doubt presents a remarquable divergence, I hesitated to base a new genus on

this feature, because our specimen presents the main characters, by which the genus *Moniligaster* is characterized, viz. a single pair of spermathecae, with a long, narrow duct opening in the intersegmental groove VII/VIII; a single pair of sperm-sacs, with sperm-ducts terminating in a prostata, which opens between segments X and XI, and a moniliform gizzard. As stated in a preceding paper, I found that in *Monilig. Houtenii* the oviducal pores neither have the position indicated for the other species of this genus, but are situated upon segment XIV. It appears to me probable that the position of the oviducal pores, which nearly in all other earthworms is constant on segment XIV, is liable to some variation in the family of the Moniligastridae. Therefore I thought it preferable to range this Borneo-worm in the genus Moniligaster, and to await wether the discovery of a new species perhaps might throw light on this questionable point of their structure.

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EXPLANATION OF PLATE 7.

Fig. 1. *Moniligaster coeruleus* Horst. One of the setae. × 40 diam.;

1*a*. Distal extremity of a seta, highly magnified.

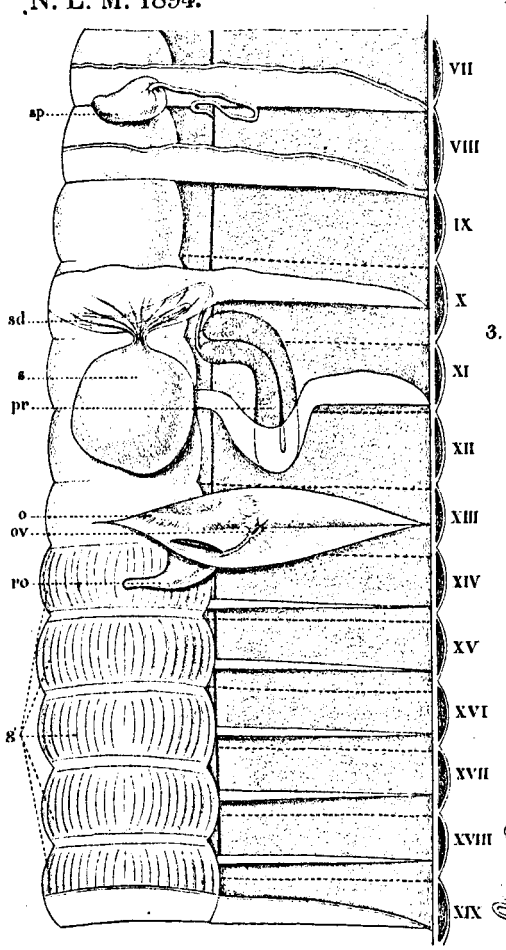
Fig. 2. A nephridium. × 5 diam.

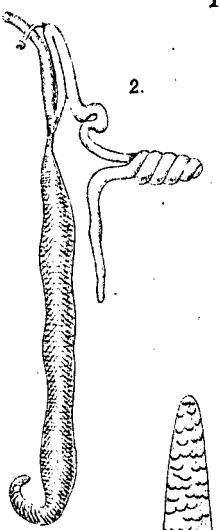
Fig. 3. View of the right half of thirteen segments (VII—XIX) of the dissected worm, to illustrate the arrangement of the genital organs. × $2^1/_2$ diam.

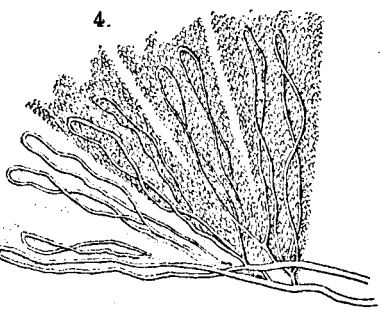
g. gizzards; *o*. ovary; *ov*. oviduct; *pr*. prostata; *ro*. receptaculum ovorum; *s*. vesicula seminalis; *sd*. spermduct; *sp*. spermatheca.

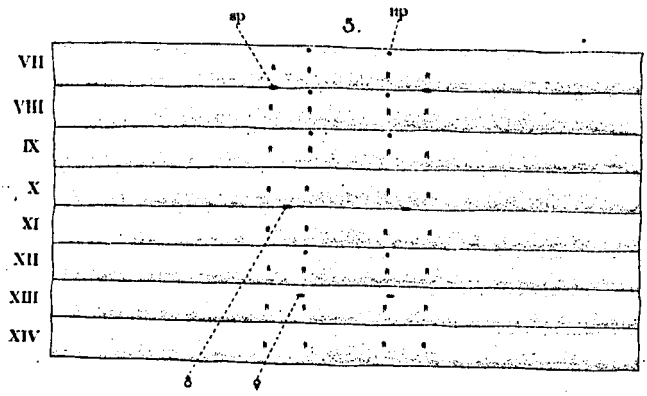
Fig. 4. A portion of the ovary; highly magnified.

Fig. 5. Ventral view of the body-wall of eight segments (VII—XIV), cut through along the dorsal line and spread out: *np*. nephridiopore; *sp*. spermathecal pore; ♂. male pore; ♀. oviducal pore.









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Moniligaster coeruleus *Horst.*